

GROUNDWATER
UNDER THE DIRECT INFLUENCE
OF SURFACE WATER
FINAL REPORT
APRIL 1998

GROUNDWATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER DETERMINATION - COMMUNITY PWS SYSTEMS - A DESCRIPTION OF THE PROCESS CONDUCTED BY THE OFFICE OF PUBLIC HEALTH

After an extensive, multi-agency project, the Department of Health and Hospitals, Office of Public Health's Safe Drinking Water Program determined that none of the wells field identified or on the list of candidate wells provided by the U.S. Corps of Engineers (COE) should be classified as Groundwater Under the Direct Influence (GWUDI). The determination rationale summarized herein is fully documented in previous documents¹. A summary of the final determination is presented below.

Community PWS wells evaluated -	2605
Number remaining after COE GIS study -	287
Number sent to Regions for field verification -	204
Number subject to MPA evaluation -	33
Number requiring 3 rounds of MPA plus Bac-T sample -	7
Final determination of GWUDI for Community Systems -	0

Background

After the COE evaluation² of well location in relation to known surface water features (Criteria 1) using GIS techniques and exemptions based on well depths and confining layers (Criteria 2 and 3), the OPH regional personnel conducted field proofing of the selected sites by completing an Exemption Form which recorded the actual measured distance to a surface water body. Additionally, well logs from the Department of Transportation and Development, Water Resources Section were requested for the subject wells. If the basic criteria of 200 foot distance from a surface water body and a clay layer were confirmed by examination of the driller's log and a surface seal was confirmed by field investigation, the well was dropped from further consideration. If the measured distances were within the 200-foot parameter or if well logs were not available, the subject well was selected for Microscopic Particular Analysis (MPA).

OPH entered into a contract with Environmental Associates, Inc. to provide staff training and perform the physical evaluation of samples from the specified wells. Samples would be collected and shipped to the laboratory at Environmental Associates, Inc., where they would be analyzed using EPA methodology.³ Training was conducted in the New Orleans area on June 29 - 30, 1994 by Dr. Susan Boutros. For more details refer to reference material "Training On GWUDI Determinations, A Workshop."⁴

During field investigations and routine sanitary surveys, additional candidate wells were noted by field personnel to be within the set 200 foot setback, and thus were MPA sampled without having first been on the candidate list provided by the COE.

Two consecutive low risk sample MPA analyses were necessary to remove selected wells from further consideration. See Table 1.

Table 1

Following groundwater systems EXEMPTED from GWUDI
AFTER TWO CONSECUTIVE LOW RISK MPA RESULTS

REGION	SUPPLY NAME PWS ID#	RESULT (Sample date)		
		1st ROUND	2nd ROUND	3rd ROUND

9	Marina Del Ray 1103123	Low Risk 10/21/94	Low Risk 12/6/94	Low Risk 3/21/95
2	Mut's Paradise Point Campsites 1063032	Low Risk 8/4/94	Drilled new well sampling not needed	
2	Old River Camp. 1077028	status changed non-comm.		
2	French Oakwood 1105017	Low Risk 8/26/94	Low risk 2/15/95	
4	Lawco-Loreauville 1045007	Low risk 9/13/94	Low Risk 11/1/94	
4	Lawco-New Iberia 1045009	Low risk 9/13/94	Low Risk 11/1/94	
4	La Neuville Holiday Subdivision 1055099	Low Risk 9/27/94	Low Risk 11/21/94	
4	Shenandoah Est. 1055155	Low Risk 10/5/94	Low Risk 11/21/94	
4	Hidden Hills 1097026	Low Risk 10/25/94	Low Risk 12/21/94	
4	Atchafalaya acres 1099013	Low Risk 11/29/94	Low Risk 12/13/94	
4	Town of Erath Nearest Barn	Low Risk 9/20/94	Low Risk 11/15/94	

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Following groundwater systems EXEMPTED from GWUDI
AFTER TWO CONSECUTIVE LOW RISK MPA RESULTS

REGION	SUPPLY NAME PWS ID#	RESULT (Sample date)		
		1st ROUND	2nd ROUND	3rd ROUND

4	Town of Erath Nearest tower 1113005	Low Risk 9/20/94	Low Risk 11/15/94	
4	Grand Prairie Subdivision	Low Risk 9/20/94	Low Risk 11/15/94	
5	Perello's T.P. 1019033	Low Risk 1/10/95	Low Risk 2/13/95	
7	Southern Trace Near entrance 1017071	Low Risk 10/5/94	Low Risk 12/13/94	
7	Southern Trace Near tennis court	Low Risk 10/5/94	inactive	
7	Southern Trace WS Green#8 well	Low Risk 10/13/94	Low Risk 12/13/94	
7	Southern Trace west of other well	Low Risk 10/5/94	Low Risk 12/13/94	
7	Camp Ti-Wtr System 1069001	Low Risk 10/12/94	Low Risk 12/27/94	
7	Peg leg Cove WS#2 1085018	Low Risk 9/26/94	Low Risk 12/19/94	
7	Fleming's Quiet Cove Water System	Low Risk 11/1/94	Low Risk 12/12/94	

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7	Cozy-Point Landing 2085010	Low Risk 1/9/95	Low Risk 4/12/95
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Central Office staff developed the final criteria for exclusion from further testing or designation as GWUDI. All wells with medium and high risk MPA analyses would be sampled three times in a variety of conditions to tie the sampling time to as many conditions as possible (i.e. high water table, seasonal fluctuations).

If further research into the files found additional information, the wells could also be exempted.

As an additional screening tool, bacteriological (Bac-t) investigative samples were collected at the well head at the time of the third round MPA test for high and medium risk wells.

The following discussion centers on the seven (7) candidate system wells that received a Moderate or High risk MPA evaluation. See Table 2 for a listing of the wells. Only those 7 wells that required additionally MPA testing and Bac-T sampling will be discussed here.

TABLE 2
GROUNDWATER SYSTEMS UNDER FURTHER CONSIDERATION FOR GWUDI
GROUND WATER MPA RESULTS

REGION	SUPPLY NAME PWS ID# POCID# DOTD#	RESULT		
		1st ROUND	2nd ROUND	3rd ROUND + Bac-T Results
9	Towering pines 1103133 9ARF-DBR4 (Unknown DOTD#)	Moderate Risk 12/6/94	Low Risk 12/12/94	Low Risk 4/10/95 (Bac-T Negative)
9	Tchefuncte Harbor 1103136 9ARP-DBR4 103-1038	Low Risk 10/6/94	Moderate Risk 11/15/94	Low Risk 3/20/95 (Bac-T Positive, Repeat Negative)
9	Lake Ramsey 1103139 9BZD-DBR4 103-652	Moderate Risk 9/15/94	Low Risk 11/1/94	Low Risk 5/2/95 (Bac-T Negative)
4	Mr. B's T.P. 1055052 4DGB-DBR4 (Unknown DOTD #)	Low Risk 10/18/94	High Risk 2/6/94	Low Risk 5/24/95 (Bac-T Negative)
4	Lakeview Estates 1055153 4DQN-DBR4 055-797	Low Risk 10/10/94	High Risk 11/30/94	High Risk 5/15/95 (Bac-T Negative)
4	Town of Breaux 1099003 Bridge 4FAZ-DBR4 099-184	Moderate Risk 10/17/94	High Risk 12/12/94	Moderate Risk 5/9/95 (Bac-T Negative)
5	Kinder 1003005 5AAW-DBR4 003-382	Low Risk 1/10/95	Moderate Risk 2/13/95	High Risk 4/18/95 (Bac-T Negative)
7	Armstrong MHP 1017001	Moderate Risk 9/22/94	Low Risk 12/12/94	Moderate Risk 2/6/95

	7CAD-DBR4 (Unknown DOTD#)			(Bac-T Negative)
7	Peg Leg Cove WS#1 1085018 7IBQ-DBR4 (Unknown DOTD#)	Low Risk 9/26/94	Moderate Risk 12/19/94	Low Risk 4/12/95 (Bac-T Negative)

DISCUSSION

Towering Pines Center

PWS ID # 1103133

Two wells in the system. The primary well was sampled using MPA because it was the closer of the two. Both casing were elevated before testing since both well heads were originally constructed below ground. Since both wells operate on suction pumps, the static water level must be near the surface. Neither flowed when the sampling taps were opened at the well head. MPA sampling was done at the tap on the smaller pressure tank.

The adjacent water body is a pond probably created when material was excavated for the nearby interstate overpasses were built.

Well water exhibited a sulphur smell. No logs were available for the well, nor could a match be made with wells on file with DOTD.

This well was determined NOT to be under the influence, with 2 lows and a moderate plus a negative bacteriological. Any possible contamination could be from the long runs of at-ground-level piping under suction (a plumbing problem), rather than from the well being under the influence. Therefore a relocation of pump house would be a future option instead of adding costly surface water-type treatment (filtration, etc.)

Lake Ramsey (AKA Artesian Utilities)

PWS ID # 1103139

The 10" flow well at Lake Ramsey was matched with DOTD# 103-652. Originally scheduled by USGS under the name of a former owner, Willie Core, the well was reported to flow with a pressure of 41 psi when drilled. The well is reported to be 3354 feet deep with 85 feet of screen.

Piping at the surface directs flow to both the lake and the water system pressure tank. In the photos, a large amount of water can be seen flowing through a manifold the cascading into the lake.

The flow and pressure from the well must be sufficient to pressurize the storage tank and provide water to the system. The booster pumps never cycled on during the inspection. The condition of the pump packing with roots growing in them would indicate that the pumps may not be operational.

A well of this depth and flowing at the high pressure could NOT be under the influence of surface water. Thus the identification of algae and diatoms in this well bring into question their reported presence in other wells.

Tchefuncte Harbor
PWS ID # 1103136

The 6x4 inch well for Tchefuncte Harbor was originally registered by DOTD as well# 103-1038 for Cypress Cove Marina. The static water level for this artesian well was measured at 2 feet below ground surface when drilled. The present static water level and pumping level must be near the surface since suction pumps are used to feed and pressurize the storage tank.

For iron control, a sequestering agents is used. The system also has continuous chlorination.

Had the driller's log been received prior to start of MPA testing the well would have been exempted by the clay layers noted on the log. A 75-foot clay layer is shown between 25 and 100 feet, then a 100-foot clay layer is shown between 180 and 360 feet. The registration form indicates full depth grout in the annular space.

Based on the inconclusive Low/Moderate/Low MPA readings and the follow-up negative bacteriological sample, this well was determined NOT under the influence.

Town of Breaux Bridge
PWS ID # 1099003

This well was the closest one of the city wells to Bayou Teche, measuring 109 feet from that surface water body. The well was sampled because the variations in subsurface descriptions from the USGS/DOTD drilling logs for this and the nearby wells. The system has continuous disinfection.

Based on the non-detection of giardia and cryptosporidium, and inconclusive detection of algae, the well was determined NOT to be under the influence. Discussions with the company that drilled this concluded the possible introduction of algae from the line shaft lubrication system and not direct connection with the adjacent surface water body. Problems of this sort could be identified by sanitary surveys and solved with routine maintenance, cleaning, and disinfection of the well screen, casing and appurtenances.

Mr. B's Trailer Park (deleted from PWS Inventory)
PWS ID # 1055052

This system is no longer in operation as Public Water System since it connected to Lafayette as customer. However, at the time of the GWUDI evaluation, this was an active system with at least 2 water wells supplying the trailer park.

Although no corresponding records for the selected well were matched with DOTD files, the other wells in the area are generally 100 feet deep and are screened in the upper Chicot Aquifer. Based on the non-detection of giardia and cryptosporidium, and inconclusive detection of diatoms, the well was determined NOT to be under the influence. Any possible interconnections may have been from construction deficiencies, lack of vent pipe and improper sealing of the well head. However, this well and the adjoining one are used strictly for irrigation and watering purposes, thus not a candidate for further evaluation.

Lakeview Estates
PWS ID # 1055153

This well was selected for MPA monitoring since field investigations confirmed proximity to a surface water feature, a coulee (stream) 25-feet from the well. The well was reportedly screened between 127 and 148 feet below surface in the upper Chicot Aquifer. The driller's log reported forty feet of clay at the surface. Based on the non-detection of giardia and cryptosporidium, and inconclusive detection of diatoms and algae, the well was determined NOT to be under the influence. Any possible interconnections may have been from construction deficiencies and improper sealing of the well head. Thus, any deficiencies may be identified in sanitary surveys and corrected with normal maintenance. However, in light of the Louisiana's Mandatory Disinfection Rule and the fact that the system has experienced one or more bacteriological MCLs from samples in the system, continuous disinfection is recommended.

Kinder
PWS ID # 1003005

Evaluation of the city of Kinder well presents an interesting problem. The well actually was not located close enough to a surface water feature, however was placed on the list because of the high tannins color exhibited by the water. City personnel report the color results from the aquifer being a remnant of a buried cypress swamp. The system blends the produced water with water purchased from another system to achieve a more aesthetically acceptable product.

The 888-foot well is screened in the Evangeline Aquifer. The well's 14-inch casing was fully grouted from ground surface to 835 feet. It is very doubtful that MPA samples taken from a fully grouted well this deep should exhibit any surface water features. However, diatoms, rotifers, and algae were reportedly collected and identified in the MPA samples. It is believed that at surface mechanical features of the wellhead could be causing the contamination, NOT GWUDI conditions. The line-shaft turbine pump is water lubricated. It should be noted that a leaky valve is noted just upstream of the

water pre-lube line. The system disinfects with continuous chlorination. This stand-by well as determined NOT to be under the influence of surface water.

Armstrong MHP

PWS ID # 1017001

This well, with submersible pump, is reported to be approximately 200 feet deep. No match was made with DOTD well records, however other nearby wells made in the Wilcox Aquifer range in depth from 170 to 270 feet deep. The well was located within 100 feet of the nearby oxidation pond. For disinfection, the system chlorinates at each well location.

Based on the non-detection of giardia and cryptosporidium, and inconclusive detection of algae, the well was determined NOT to be under the influence. This system has experienced distribution problems from inadequately screened storage facilities which may require future monitoring. Problems of this sort could be identified by sanitary surveys and solved with routine maintenance, cleaning, and disinfection of the storage facilities and the well screen, casing and appurtenances.

Peg Leg Cove WS#1

PWS ID # 1085018

This air-lift well was found to be within 100 feet of Toledo Bend Reservoir. The depth of this well is unknown and no match was made with wells in the DOTD inventory. However, adjacent wells are made in the Sparta Aquifer and range from 110 to 250 feet deep.

The MPA sample detected algae in the water sample. A sanitary survey conducted in May 1995 advised the system of the need to keep the air compressor clean and the air carefully filtered. By nature of this arrangement, contaminants could have been inadvertently introduced into the annular space.

Based on the Low/Moderate/Low risk ratings and inconclusive detection of algae, the well was determined NOT to be under the influence.

Summary

Louisiana has numerous rivers, streams and lakes across the landscape. Therefore, it is doubtful that present future locations could be found to obtain maximum distances from all surface sources. Set-back distances in the DHH State Sanitary Code and in the DOTD Water Well Rules Regulations and Standards have served as the basis for providing minimum distances from possible sources of contamination. These distances and the subsurface geology by means of clay layers have provided protection for wells.

In certain areas of the state, especially along the Mississippi River, certain the wells flow during flood stage thus showing the hydraulic connection to the river. However, this hydraulic connectivity or distance from a surface water feature should not be automatically considered GWUDI.

Other states found sandstone, limestone and other porous material more vulnerable to transport of particulates than sand and gravel aquifers. Therefore, Louisiana's geology does not exhibit the problems that would effect the Edwards Aquifer in Texas , a limestone karst aquifer with cavernous and fracture porosity. Louisiana's geology with intermittent sand and clay beds would cause attenuation of the movement of larger particles like giardia and cryptosporidium. Louisiana's lack of springs, dug wells, infiltration galleries, and rock wells for public supply sources eliminate those types of highly influenced sources from consideration as GWUDI.

Additionally, a USGS report⁵ to determine the rate and direction of movement and fate of viable fecal-coliform (FC) bacteria in an aquifer found "the combined effects of dilution, sorption and filtration greatly attenuated FC-bacteria concentrations in the shallow aquifer system. The rapid decrease in concentrations of FC bacteria, compared to relatively slow ground water movement, substantially limits the extent of contamination of shallow aquifers."

Although the fecal coliform limits referenced in the report were for recreational waters primary contact levels(200 colonies / 100mL), the bacterial removal demonstrated in the study from the shallow aquifer filtration reduced the detected concentration to 95 cols/100 mL from the control tank concentration of 180,000 cols/100ml, a 99.95 percent reduction.

CONCLUSIONS

As a result of this study, NO Community Public Supply Water wells were determined to be Groundwater Under the Direct Influence of Surface Water (GWUDI). No confirmed or presumptive Giardia cysts or Cryptosporidium oocysts were identified in the Microscopic Particulate Analysis (MPA) in any of the collected samples for the targeted Community Public Supply water wells.

However, if identified or suspected in subsequent evaluations, any PWS water well could be added to a candidate list and evaluated as GWUDI in the future using MPA or other determinations, and thus be required to install filtration.

REFERENCES

1. Ground Water “Under the Direct Influence” Of Surface Water, Interim Report, July 1994.
2. Groundwater Aquifer Survey and Surface Water Influence Analysis, Planning Assistance to States Study, U.S. Army Corps of Engineers, NOD, February 1995.
3. Consensus Method for Determining Groundwaters Under the direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), U.S. EPA, October 1992
4. Training on GWUDI Determinations, A Workshop, Susan N. Boutros, Ph.D.
5. Movement and Fate of Fecal-Coliform Bacteria Through a Shallow aquifer System in Southeastern Louisiana, 1991, Water Resources Technical Report No. 56, USGS and DOTD